Non-Provisional Patent Application - (Utility)

SPECIFICATION

TO ALL WHOM IT CONSERNS:

With reference to **Prior Provisional Patent Application Number 60/440,773 Filed on 01/17/2003, submitted by "RWMS Group", Smith,** and therefore continuing...

BE IT KNOWN THAT THE COLLECTIVE GROUP KNOWN AS "RWMS Group" of Pensacola Florida, and having established an address for business, **and** with that address being "RWMS Group", 1014 Barnett Drive, Pensacola Florida 32505, **and with First Inventor and Partner named Lee A. Smith,** a citizen of the United States of America, currently residing at 1014 Barnett Drive, Pensacola, Florida, USA, 32505 **and with Second Inventor and Partner named Thomas G. Villeneuve,** a citizen of the United States of America, currently residing at 206 South Pinewood Lane, Pensacola Florida, USA, 32507, **and with Third Inventor and Partner named David W. Kizzire,** a citizen of the United States of America, currently residing at 605 Edison, Pensacola Florida, USA, 32505 **have collectively invented the item described by this document, and DECLARE that the following represents its Specification:**

[Residential Water Management System (RWMS)]

1. Field, Background and Purposes of the Invention:

Field: The invention relates to a Logic Based Electronic Controller Device for monitoring and control of ones residential and or small business water piping system, also frequently referred to as plumbing. This device utilizes state of the art electronics and programming for the control of and in concert with various forms of peripheral devices including: electrically activated solenoid valves for control of water flow through a piping system, and with pressure sensor(s) for the purpose of receiving signals which are used to monitor water pressure within a piping system, and with Flow Counting Devices for determining volumes of flow through piping measured in U.S. Gallons, and with thermal sensors for the purpose of receiving signals which reflect the temperature of water in a water heater measured in thermal degrees Fahrenheit, and with electrically actuated relay(s) for the purpose of controlling the flow of electrical or gas energy which produce a heat source for heating water, and with a plurality of solenoid valves for the purpose of irrigation.

Background: In the United States alone, repeated from town to town, trillions upon trillions of gallons of treated and potable water are lost each year due to two major deterrents to conservation efforts. These two seem insurmountable until seen in the light of simplicity. First and most obvious yet also most ignored is leaking plumbing fixtures and pipes. Estimates from the largest water management districts throughout the United States reflect that as much as 1/3rd of all water ever produced for potable water supply is simply lost to dripping leaks due to bad flapper valves in toilets and leaking washers in faucets and fixtures or underground-undetected leaks. Since an estimate of the volume of this loss for one major Southern California Water District reaches an approximated **10.3 Trillion Gallons per year** and the much smaller Utility supplying the local Pensacola Florida area looses another **.75 Trilli n Gall ns** to the same foe, it simply boggles any reasonable mind to imagine what the National and or even Worldwide loss volume would be. Particularly when it is realized that this terrible waste is caused by PROCRASTINATION for the most

part. Most people recognize a sound that is heard in the stillness of the night or the quietness of a day when a toilet runs for a few seconds and then runs again a few minutes later. While simple replacement with a new flapper valve would stop this, and this item costs less than 10 dollars U.S., night after night we ignore the sound until it becomes a part of our normal household sounds, and then we forget it all together, thus the dilemma. Likewise we see or hear dripping in tubs, showers, and sinks or hose bibs and ignore them also. Thus the dilemma is compounded. To solve this, it is reasonable to expect that if a system would provide a gentle but constant prompting, that most would seek to repair these leaks and thus save a dwindling and precious resource. The second deterrent to successful water conservation on a scale, which could make a difference, is that **in order for Water Conservation Participation to increase in homes and small businesses, the user must have easily acquired information, which is essential for conservation planning and monitoring the success of such a plan**. Currently the public at large is only given the totally inconvenient task of walking to the water meter and digging through mud and spiders to take a visual reading of their water usage. Only to be followed by a mathematical formula which first converts the reading from Cubic Feet of Water to Gallons of water? This is only made more difficult for many by the fact that the last two digits of that reading often only reflect hundredths of a single cubic foot so many miscalculate believing these to be whole numbers. Following a correct conversion, the "potential home conservationist" is then required to perform a more simple mathematical subtraction of any previous gallons from the current calculated gallons results. This then finally results in the amount of usage that has occurred since this laborious task was last accomplished. Imagine that you want to know how much you use during a shower and you have to do all this each time, and how much your children used and you must do it again, or how much you used yesterday, last month, or even how much you used last year? What is your average usage per day, week, month, or year? **How many trips to the meter and mathematical conversions and subtractions would it take to gain all of this information which is paramount to home conservation planning and success?** Even more important is... **how many trips to the meter before you stop participating**? And so in lies the problem! This type of activity is far too laborious and time intensive, and while studies around the country show that people are willing to assist in conservation, participation is scarce at best. **To combat this deterrent to participation in conservation requires a device that mounts in a convenient location in the home or small business setting. A device, which constantly gathers this information for you, and displays it back to you through easy to navigate menus**. With such a device a family could make conservation a fun daily activity, and thus create a habit of conserving. Children would gain tremendous pleasure in having such a device to count how much they use when they shower, and then write it on a simple tracking chart so that they can see the gallons that they are helping to save. And if this device would also allow you to set a daily amount which would be your overall usage goal and it would give alarm when you exceed that amount, then people would begin to think about why the alarm had sounded, and if it were a result of water waste. Given the correct tool, participation in home water conservation would reach numbers never dreamed possible by Townships, Utilities, Water Management District, and Boards. Each having staffs of employees trying to elicit this support and having goals for their water conservation programs. While **the device that is specified in this application was developed to specifically address these critical conservation issues**, it was evident to us that such a device could do so much more at the same time. It could help to reduce the estimated 56 Billion Dollars spent each year in insurance claims for water damage to property caused by plumbing leaks. It could reduce the Billions that are expected to be spent each year on Health Related issues arising from Toxic Mold Related Illness that require water to live and grow, and where plumbing related leaks have been determined to be the number one cause. But why stop there? **Why not a fully augmented device for total control of all aspects of a plumbing system in the home or small business**? Able to also control hot water heater on and off states and set the temperature that they operate at. A Device, able to also control a lawn and garden sprinkler system. Able to drain a plumbing system so that pipes don't burst due to freezing during the abscense of the property owner. A device, that causes a plumbing system to sleep when you do. A device, operating from user programming that matches daily lifestyle. Thus the single

device, which does all of this, is represented by this application for patent and is called the Residential Water Management System, yet it's design and purpose also fit the needs of the Small Businesses as well.

Purpose(s) of the Inventi n:
The purpose(s) are to help to solve Water Conservation Deterrents by eliminating water waste due to leaky plumbing and fixtures and to provide the necessary tool to user that make Home and Small Business Water Conservation Participation simple, thus encouraging this participation in numbers that dwarf those currently realized. Additionally, the RWMS will control unwanted water flow, defend against damage caused to property by water leaks, defend against development of mold spores developed when plumbing leaks, defend against damage to ones hot water heater and or fires caused by operation of empty heaters due to plumbing leaks, provide programmable control of Irrigation Specific water usage, and provide a tool to fully monitor ones home or small business water usage data and or statistics. The system will automatically control an electrical operated hot water heater to include its on and off states, and also to include its operating temperature. The RWMS has the optional ability to provide gravity siphon and or pump assisted purge and or drain function to evacuate the water from a plumbing system. This function will allow the home and or business owner to purge their water system during vacations or extended periods away from the structure for the purpose of preventing freezing related bursting of pipes and or plumbing. Use of this system throughout America and the World could eliminate 1/3rd of the water waste due to leaky plumbing and fixtures and elicit additional water resource savings through encouragement of conservation participation. Our invention will significantly aid in the ongoing Water Conservation Efforts at the Federal, State, and Local levels, by giving the Residential and Small Business user a easy to use and centrally located source for water monitoring, with return data about usage in gallons without their having to perform complex mathematical calculations and without the need to leave the dwelling or business interior. The largest portion of the population WILL NOT go to their water meters and back calculate water consumption. But they would use a home appliance that counted their use for them. Studies by Automobile Associations show that 96% of people who receive various warning lights while driving seek same day repairs, thus if the same were true when the device warned of leaks then the savings in Water Resources would be tremendous. The RWMS device is of particular importance for installation in Multi Level Condo and Apartment Complexes, where water leaks in higher units gravitate downward and compound damage by also damaging vertically adjacent units.

2. **Difference to the related art:**
While several patents have been granted for somewhat similar products, and their merit is recognized, they are NOT fully augmented Water Management System(s). They also employ methods of leak detection which cannot determine small leaks since drip detection is not easily facilitated through flow detection. Others rely on moisture sensors placed throughout a structure, which can easily fail to detect water leaks at all. Others are not cost effective for the home or small business owner. An example of a system that is not cost effective is seen in the prior art Patented as 5,441,070 8/15/95 by Thompson, which deploys an array of flow detecting sensors, solenoid valves and wiring to **all** water usage points within the entire structure. This approach, though effective for fluid flow control, has complexity and high costs that would make it less desirable than the few peripherals that are needed by the RWMS. Installation of 5,441,070 would not allow for Home Do-It-Yourselfer installation even by the most savvy and would be a complex, costly and time consuming task even for a Professional Plumber. Further, installation of this item of prior art would be even more problematic and less desirous in existing structures. Further, maintenance for 5,441,070 would expectedly be much more intensive and most likely more frequent since there are so many points of possible failure. Another disadvantage of the items seen in the current prior art is that they do not allow for control of the water heater in a plumbing system. Without this control any system falls shy of being a total water management system, since the water heater is a standard part of the water/plumbing system in any Dwelling or Small Business. Another item seen in the

related art uses a device which transmits information about water usage through telephone and or radio communications to a centralized monitoring system, which adds to the cost of the use of the system on a incremental (monthly/quarterly/annual) basis, being unlike the RWMS which would require only the initial cost of installation.   Another item of prior art requires installation that places the controls for the system outside of the users actual dwelling or business property or in locations that would not be considered by the user to be convenient to daily lifestyle. The discovered related art (to date) do not constitute the functionality of a full and complete Residential Water Management System (RWMS). They do not have a water counter mode and information provided to the user Onscreen for individual water usage events such as showering, washing dishes, etc, which is stated as "The paramount Innovative Technology Needed for Effective Water Conservation Efforts and Public Awareness and Participation in Water Conservation Goals" as stated by Major Water Management Boards, Districts and Utilities.   Items of Related Art do not have user activity oriented modes of operation that are designed to match user lifestyle. They do not have the ability to determine smallest of leaks which are reported by the Water Conservation Authorities to be the worst form of water waste, dripping away as much as $1/3^{rd}$ of Potable Water Produced in many Water Management Districts. They are not Specification Direct Devices that encourage and empower users to establish and succeed in Home Water Conservation Planning and Execution. They do not have valves that remain in last state in the event of a power outage but rather could return to the improper state during Commercial Power Outages, leaving the Owner/User unprotected or without any water for a period of time until Power is restored.   They do not digitally record total usage amounts into internal memory devices to support user in statistical recall of this data thus lowering water consumption or validating water statements. They do not incorporate water system control for both normal Residential and or Small Business water use with Irrigation System Control in a single attractive wall mounted controller device conveniently located in the dwelling or structure. Additionally, and not to their discredit, but rather to the simple factors associated with the timing of technological development, their systems rely on outdated technology and are not able to take advantage of modern microcomputer processing technology, miniaturized circuitry and memory devices now available to the RWMS, and without which such a Total Water Management System being delivered to the user in a single Logic Based Electronic Controller was impossible.   Thus the name of our device matches it's functionality, and IS a complete and total Residential Water Management System (RWMS).

Though there were many other Items of Related Art that were reviewed as part of this applications preperation, those which were found to be most closely related are listed below, and are submitted for the convenience and cosideration of the Examiner:

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6,119,720.......Sep. 19, 2000.......Isaacson Jr. et al
5,086,806.......Feb. 11, 1992.......Engler & Johnson
3,416,560.......Dec. 17, 1968.......Bruno
5,251,653.......Oct. 12, 1993.......Tucker & Kestermann
4,522,229.......Jun. 11, 1985.......Moortele
4,518,955.......May 21, 1985.......Meyer
5,881,755.......Mar. 16,1999.......Dieringer
5,503,175.......Apr. 02, 1996.......Ravilious & Grant
4,180,088.......Dec. 25, 1979.......Mallett
4,911,200.......Mar. 27, 1990.......Ben-Aire
6,129,103.......Oct. 10, 2000.......Fields, Cutshaw
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Summary of Invention

There is a very simple test that is used to check for leaks in piping conduits. To do this, a temporary valve and pressure gauge is applied to the system and then pressurized with air to a specific test pressure greater than that which the operational system will bear during normal operation. The system is then checked at a later time. If the pressure has visibly dropped on the gauge then the system is determined to have a leak. Our invention capitalizes on this simple principle to facilitate an ongoing pressure monitoring and or test of a water/plumbing system and report results through an Electronic Controller device. This device then produces audible and/or visual alerts when a pressure test fails (in specific modes) as seen in both Brief and Detailed Descriptions Sections of this Patent Application. If test passes, a visual indication is presented on the controller's Display Screen, which affirms to the user the fact that water is not leaking from the piping system. The water management system outlined in this document is Specification Designed to meet the afore mentioned needs of Water Conservation by aid in elimination of simple leaks and through provision of easily acquired data relating to water usage in Homes and or Small Businesses which encourage Water Conservation Awareness and Participation. It incorporates the most accurate method of determining the presences of leaks coupled with outstanding features that afford the device operator with total water system management and monitoring from a single Electronic Controller Device. **The key to the operational excellence of the RWMS is the use of constant monitoring of Water Pressure as the methodology to determine that water is escaping the confines of a closed piping system**. With pressure as the trigger for anomaly recognition, the system THEN monitors flow of water in gallons, and will arrest all flow if outside parameters programmed by user and in various operational modes. In Sleep Mode, no more than an estimated 1.5 to 5 gallons of water may flow during such an anomaly, while in watch mode, the user may program the RWMS to allow between 50 and 200 gallons of flow during a single flow event, again which is originally triggered by the recognition of a sudden drop in static plumbing system water pressure. In "Away Mode" the system will prevent any flow at all, and maintains a closed state at the Main Solenoid Valve, and will only return to a water on condition when the user either manually changes to another Operational Mode at the Electronic Controller, or programs the Electronic Controller to automatically return to another mode at a specific date and time. Thus providing the user with Property Damage Protection that is 100% certain of effectiveness, since damage can't occur if the water is off.

For Simplicity the Basic RWMS installation consists of: 1 (one) Logic Based Solid State Electronic Controller, 1 solenoid or electromechanically actuated bi-positional valve requiring separate signals to change states, 1 pressure sensor which is sensitive to pounds per square inch of water pressure, 1(one) flow counting and or metering sensor, sensitive in 10ths of a gallon per minute. A connection for optional electrically powered water pump. A connection for an optional solenoid actuated on/off switch for Electric or Gas Hot Water Heater and for temperature sensor which applies or are affixed to standard Electric Water Heaters, and multiple connections for zone control of irrigation specific electrically actuated solenoid valves. NOTE: additional peripheral items are necessary in various modes. For instance, if a user chooses to have the ability to purge their water system from the RWMS Controller, they are required to install two additional solenoid actuated valves. If they choose the ability to use the Leak Location Feature, then an additional solenoid actuated valve and an additional pressure sensor are necessary.

The Electronic Controller itself has been developed by contract between this Patent Applicant and a Professional Electronics Engineering Firm, utilizing Knowledge and Technologies inherent to their Profession, and IAW operational characteristics provided and developed by this Patent Applicant. The sum total of the operational characteristics of the RWMS are the subject of this Patent Application. The accomplishment of design to produce these characteristics in a Single Logic Based Electronic Controller Device is inherent to the Professional Knowledge, Training and Technological Application which is standard to Electronic Development Engineers in the United States and

Worldwide and utilize peripheral components which are already manufactured and readily available from multiple manufacturing and supply sources. These peripherals are Electrically Actuated Solenoid Valves, Water Pressure Sensors, Water Flow Counting Device/Sensors, Electrically Actuated 220 VAC Switches/Relays, and Thin Thermal Sensing Devices. Therefore the focus of Utility Development and Patent ability of the RWMS is as stated in its Operational Characteristics and accomplished through various operational modes which are unique to the RWMS system. **N Federal Research and Devel_pment (R&D) aid _r funds were used to devel p the RWMS System presented in this Patent Application.**

Brief Description of Invention
(Operational Modes)

1.On Mode: (By this name or having any operational mode name in which): Water is On. Water Heater is On. No leak detection or flow restrictions are active. User must manually place RWMS in and out of this mode. The user is unprotected from catastrophic damage resulting from busted or leaking plumbing systems and or piping while in this Mode. On Mode is automatically abandoned by the RWMS system in the event of Commercial Power Loss and the system will default to it's normal operating mode, called the Watch Mode, which is described in brief in the following paragraph.

2. Watch Mode: (By this name or having any operational mode name in which): The system will allow large flows, as programmed by the user. The user sets a value in gallons for the amount of flow that enable audible and visual alerts. Upon reaching this limit, the user may also program the amount of additional flow that results in the system shutting off the water system, and water heater (if so equipped). The device will automatically return to this state as The Normal Operating Mode. **Since this value would differ from home to home and from business to business, this value is determined by the user to be the highest volume of water usage that represents maximum normal usage in their home or business property. As example, in the home this value would most likely be equal to the amount in gallons used to fill a bath-tub while in a business office setting this value would most likely be the amount in gallons used at either a sink or perhaps at a toilet.** This is the expected mode of operation of the unit during times when the user is normally home or present at a business location, and use of water is EXPECTED. Such as cooking, cleaning, taking showers, washing hands, using toilet, etc... Additionally, the user can program a Daily Amount of Expected Water Usage in Gallons as developed in individual Water Conservation Plans, which will provide an audible and visual alarm at the RWMS Electronic Controller if the twenty four (24) hour total usage of water in gallons exceeds this programmable amount without the inconvenience of having the system to turn the water off. In this way the RWMS further demonstrates itself to be a Water Conservation Device since the user can use this function to set ever decreasing goal volumes of water use at either the Dwelling or Business Property.

3. Sleep Mode: (By this name or having any operational mode name in which): A daily time(s) programmed to occur by the user of the RWMS device when the use of water is NOT EXPECTED. Best examples being: When everyone is asleep at night, or during the day when homes are vacated for work and children are in school, or in the business setting would be a time beyond the normal closing time of the business. The system will turn off the water at the supply by electrically actuated solenoid valve installed at the union of the plumbing system to the supply (IE...just beyond the Water Meter), and monitor for pressure anomalies during this time. A pressure decrease of 50% from Benchmark will cause the valve to open. (The benchmark for pressure is determined at time that mode is entered, and with ongoing re-calculations to allow for external temperature and barometric pressure changes) During any individual flow event, while in this mode of operation, the system will restrict water flow to the amount in gallons that has been determined at the initial time of installation. To do this, the unit will be manually placed into this mode

immediately following completion of installation and a toilet in the house will be flushed. Since toilets vary between 1.3 and 4.7 gallons of cyclic usage, the RWMS will be learning the amount of flow in gallons which constitute an over usage per individual installation, and will set this amount as maximum flow during any single anomaly event while in Sleep Mode. RWMS will immediately turn water off, and alert user through audible and visual alarms if this threshold is reached. By allowing for a flow of within this range, the RWMS permits those infrequent occasions when water use does occur during times when it is Not Expected. The best examples being when the user awakes in the night and flushes a toilet, gets a glass of water, or when the automatic icemaker cycles to produce ice. If so equipped, the Hot Water Heater will also be disabled (Electric Only in Initial Production, gas control to follow) through the use of a (220VAC) Relay Switch, installed inline with the Water Heater Power Source. **Should flow not reach this maximum flow amount**, and pressure return to a stable level for a period acceptable to represent a return to benchmark prior to anomaly or a new benchmark, then system will reset awaiting next pressure anomaly. **If anomalies occur with frequency during this mode,** then the system will determine that a leak exists an act according to severity estimate:

"Minor" (water is turned off, but re-awakens at any programmed time, while delivering audible and visual alerts from the Electronic Controller Assembly. The audible alarm will not begin until the programmed awaken time to prevent unnecessary awakening of the user). **Minor means that the time for Pressure to reach of drop of 50% of benchmark is equal to and represents a flow at a rate in which the potential for damage to the property is greater than acceptable but less than severe.** Water flow is disrupted for purposes of both damage prevention, and for Water Conservation The system will awaken at any user programmed time for user convenience yet continue visual and audible alarms that notify the user of the leak condition discovered during this mode.

"Severe" (water is instantly turned off, audible alarm elevates in Db level, user is required to reset alarm and water system does not awaken as programmed by user) The option to have the Hot Water Heater On or Off during this time will also assure that water heaters do not attempt to heat a possibly empty tank, thus providing fire protection as a result. **Severe means that the time for Pressure to reach a drop of 50% of benchmark was equal to and represents a significant flow with great potential to damage property and waste potable water resources.** The flow of water is stopped to prevent property damage and for the purpose of Water Conservation.

4. **Away Mode: (By this name or having any operational mode name in which):**
User causes device to communicate with peripheral devices that discontinue all water flow from source and may also electrically cause the disabling of a water heater in a water piping system. This mode can be manually entered and exited from or entered from a menu selection that allows for the setting of a pre-determined date and time in which the system would automatically return to any appropriate alternate mode. In example, if the date and time matched a programmed setting in which the system should be in the Sleep Mode, then the system would return to that mode otherwise the system would return to the Watch Mode. This mode is initiated by the user when vacating the home for extended periods of time. Best examples being: Over night or longer stays away from the Residence, or when a Small Business is closed for the weekend, etc... Of course the user can return early and wake the system manually, even if they had chosen auto-awaken during initialization of the mode.

5. **Purge Mode: (By this name or having any operational mode name in which):** One wishes to drain and depressurize the entire piping system controlled by the device. The RWMS turns off the water at the supply (main solenoid valve) and then opens two solenoid valves called the "Drain" solenoid valve, which allows water to drain outside the residence, and the "Vacuum

Release" solenoid valve, which allows an air inlet to prevent vacuum retention of water in the plumbing system. The device supports the option of having an electrically powered pump to assure complete evacuation, which can operate either on AC or DC electrical current and also supports the option of an additional solenoid that drains the hot water heater. Best examples being: Users of the RWMS device in geographic areas where extreme cold weather exists, and user wishes to prevent direct and indirect damage due to freezing and bursting of pipes during intentional and extended periods when the property is vacated. Many persons in the North of the United States spend the winter months in the warmer climate of the South of the United States, and this optional device mode will be of most significant appeal to these while many may choose this option for reasons other than that used in this example.

6. Locate Mode: (By this name or having any operational mode name in which):
The device communicates with two strategically placed/installed pressure sensors to determine whether a leak detected by the system is located on the supply section (plumbing from user point of responsibility to entry point into property) or the property section (all plumbing beyond the point of entry) A solenoid valve known as the "Locate" valve, must be installed in the exact (or closest possible) point that represents the point of entry, and a separate Pressure Sensor must be placed beyond the locate solenoid valve to facilitate this function's use.

7. Water Temperature Adjustment Mode: (By this name or having any operational mode name in which):   The unit will allow for the control of Electric Water Heater Temperatures ranging from ninety to one hundred sixty degrees Fahrenheit. To accomplish this, a modification of a Standard Water Heater Thermostat incorporates a thin temperature sensor, and communicates information equal to a thermal reading of current water temperature to the Electronic Controller. Additionally, a Electrical Relay will be placed in line with the Power Source (220 VAC), which will allow for the unit to control the Water Heater Power Source through communications with the Electronic Controller and as necessary to control temperature to the user programmed level. The control of an electric water heater has been accomplished as part of a prototype with control of gas operated water heaters currently being an ongoing process.

8. Leak Detection Message Programming Capability (By this name or having any operational mode name in which): The Controller will be able to be programmed to display the name and telephone of a Plumbing Service Provider. Initially the message should read, "Leak Detected, Call For Service" With programming, the message can read "Leak Detected, Call "XXXXXXXXX" Plumbing Service: 1-800-###-####", where the name and phone number of a plumbing company or service is substituted for the "XXXXXXXXX" and 1-800-###-####. At any time that the system recognizes and reports a leak condition this message would also appear on the Electronic Controller Display.

9. Irrigation Mode(By this name or having any operational mode name in which): The unit will allow for the control of irrigation specific plumbing from the same controller assy. As example, it also have the ability for users to set timing and zones of control to water lawns and or gardens.

Detailed Description(s) f Invention

The following describes detail about the individual operational characteristics of the modes and states related to the RWMS device. Some mode descriptions from previous "Brief Description" section do not appear in this "Detailed Description" section, in that the previous description was deemed to sufficiently describe those functions.

1. **Water On Mode: (By this name or having any   perati n mode name in which):** The RWMS System will allow the user to effectively by-pass the leak detection and flow restrictions as programmed by user. A user might need to fill a swimming pool, or initially water a newly planted garden, or to do any of a number of water usage activities that would cause other modes to disrupt water flow either determined that such usage was a catastrophic level leak or break in the plumbing system or that the maximum flow established by the user to occur in a single flowing event had been reached. This mode requires user action, at the Electronic Controller, and effectively makes all leak detection and maximum flow settings transparent and or disabled. This mode of operation is automatically abandoned by the RWMS in the event of Commercial Power Loss, and the RWMS will return to the appropriate mode as dictated by the timing programming stored in memory, and as programmed by the device Owner/User. Most Simply Stated: During this mode the water is on, and there are no restrictions to amount of Flow nor Active Leak Detection or Maximum Flow Restrictions engaged by the RWMS Electronic Controller, allowing user to cause greater amounts of flow than normally expected.

2. **Watch Mode: (By this name or having any operation mode name in which):** The RWMS operates to monitor for water flow events that are recognizable by pressure anomaly. It does this utilizing a well know and fully accepted principle of the relationship between pressure in a closed system and to the expected change in pressure when flow is increased or decreased so that when flow exists, pressure decreases. The RWMS constantly monitors for static pressure in home plumbing systems, and applies an "over time" calculation using an internal clock that equates amount of flow to static pressure decrease using a standard curve. The amount of time in which pressure drops in a closed plumbing system by 50% from the normal benchmark of pressure directly correlates to the rate or amount of flow that is occurring. The RWMS uses a logic that realizes that long periods of time for 50% pressure reduction indicate a drip condition such as leaky toilet flapper valves or faucet seal(s), while sudden or short periods for 50% reduction in pressure in that same plumbing system would represent more significant and or continuous flow. In the RWMS this reduction of pressure by 50% represents an Anomaly, and is the trigger for all RWMS Logic Based Functions in Modes where Leak Detection is active.   If the amount of time that occurs during a 50% reduction in pressure is equal to the median time of a dripping flow, then the anomaly is recognized to have found a dripping leak. Alternatively, if the amount of time that occurs during pressure reduction to 50% is equal to the median time for continuous volume flow then the RWMS activates a Water Flow Counter Device and will terminate water flow by actuation of an electrically actuated solenoid valve if the amount of flow reaches values in gallons programmed by the user prior to the anomaly. In this way the RWMS Device can also be used as a Flow Amount Delivery Device, using the accuracy of Flow Counting to deliver exact amounts of water for such purposes as irrigation or filling of pools or Jacuzzi. The RWMS uniquely solves the problem of accurate detection of dripping leaks, while continuing to allow normal daily water usage activities in the dwelling or structure. This also uniquely separates the RWMS as a Water Conservation Specific Device, since it will stop water waste from such things as Busted Garden Hoses, Underground Pipe Bursting and other wasteful long time and volume flows of Potable Water. As an example, the following user related characteristic of use:

> The user might choose to have 50 gallons of water set as a base flow restriction for any given individual flow event. Another user of the RWMS might choose that this same flow restriction be 200 gallons. And both RWMS users having the ability to change this setting from an Electronic Controller mounted inside the Dwelling or Structure. The RWMS operating in this mode will then monitor pressure in the system to watch for Pressure Anomalies. If the anomaly is determined to be a constant and or lasting volume of flow the

RWMS will then restrict the total flow amount to the prescribed user amount in Gallons, while maintaining the unique ability to detect small dripping leaks and report them.

Additionally, the user can program a Daily Amount of Expected Water Usage in Gallons as developed in Individual Water Conservation Plans, which will provide an audible and visual alarm at the RWMS Electronic Controller if the twenty-four (24) hour total usage of water in gallons exceeds this programmable amount. In this way the RWMS further demonstrates itself to be a Water Conservation Device since the user can use this function to create ever-decreasing goals for their total volumes of water use with the RWMS providing feedback for both success and failure to meet individuals pre-determined daily goals for total water usage.

3. **Sleep Mode: (By this name or having any operational mode name in which):** User Programmed Time when water use is not normally expected. An example would be to have the water system placed into Sleep Mode at Midnight and to awaken from sleep mode at 5 AM. For these 5 hours the water system would be turned off, and the system would monitor pressure readings alone. No loss of pressure would mean that the system has no leaks. The unit could be programmed to automatically enter Sleep Mode based on three daily begin sleep and end sleep mode settings which are Owner/User programmable. This allows for a Morning, Afternoon and Night setting(s), when most people are not using water in their homes or small businesses. If only the user enters one setting, then only that setting would automatically place the RWMS in this mode of operation. The system also allows for three additional times to be specified during the weekend period, which further allows the user to program this mode around their normal lifestyle and schedules.

During this time...unexpected water use may occur. For instance a family member might need to use the rest room, get a glass of water, or the Ice Maker might go through a dump and fill cycle. Such an occurrence would significantly decrease pressure in a closed water system in a rapid manner, this sudden decrease in pressure (specifically when 50% of normal pressure has diminished) would trigger the system to turn the water back on for a time which would allow for any normal but unexpected water usage, but to a limit of total flow which has a maximum programmable value which will be determined at time of installation as previously described in the Brief Description section of this application. If flow does not reach the maximum user programmed and allowable value stored in memory expectedly to be between 1.5 and 5 gallons, and pressure returns to the benchmark pressure, then the RWMS will again close the Main Solenoid Valve, and return to Pressure Monitoring alone. Since water that is used during these in-frequent times is almost always cold water, the system can put the Water Heater to Sleep, saving more Energy resources. Also, hot water tanks are very well insulated and thus can hold sufficient hot water without heat source for enough time that need for occasional hot water during these times would not negatively impact on the user. Additionally the RWMS can be programmed with a minimum water temperature that does not promote growth of bacteria such as that that causes Legionnaires Disease, etc.... Since the system will wake up at the prescribed/programmed time, it will also awaken the water heater, and will be ready to deliver hot water to the user on demand and return itself to the Watch Mode.

Naturally Sleep Mode should not be activated during the same timing settings of a separate Automatic Lawn/Garden Watering system. Since many that would install the RWMS already have irrigation systems, then it is expected that they would install RWMS systems that do not have the Irrigation System Control function since this model of the RWMS would naturally cost less.

4. **Away Mode: (By this name or having any operational mode name in which):** The RWMS allows for the user to place the water system and water heater in the off position. This is used for extended periods where the user intends to vacate the property, but does not wish to fully purge the water system. This mode is the Emergency Off Mode as well, although a button is designed on the Controller Face that allows for Instant Off without having to enter the menu

system. It is noteworthy that instant off mode if connected to an electric water heater could also be used in the event of electrical fire at the water heater itself. Instructions with the unit will teach the user to simply press the Instant Off button either in an emergency or when going away for brief periods. If the user is planning to be away from the dwelling or structure for extended periods it would be best to use the Menu System to activate the Away Mode, since through this mechanism the RWMS can be programmed to automatically awaken the water system and water heater by calendar date and time, thus preparing adequate hot water supplies for on demand use when the user returns while providing protection from catastrophic damage prior to the users return to the dwelling or small business structure. This mode absolutely assures that damage and water waste cannot occur since the water system will be totally disabled by activation of the Main Water Solenoid Valve and cannot flow beyond that which would leak from the volume of water already existing in the closed water system beyond the Main Solenoid Valve. Away Mode differs from Sleep Mode in that a Pressure Anomaly will not trigger the system to turn the water back on, but instead would trigger the system to report a leak since the closed system would experience a complete decrease in pressure. This loss of pressure can be simulated in ANY water system which has been turned off at the source, by opening a faucet and watching an initial water flow of significance which then decreases in volume until there is No Flow at all, since static system pressure decreases to No Pressure when disconnected from the pressure source, normally being Utility Water Supply or Well Head if there is a point in which flow is allowed.

5. Purge Mode: (By this name or having any operational mode name in which):
Used When the home or business owner needs the added security of being able to remove the water from their plumbing system. Best example would be for those times when users located geographically in areas of extreme cold wish to vacate their property without the damage and water waste associated with busted plumbing due to freezing. The user would place the RWMS system into Purge Mode, and the solenoids would all open in the manner already described until the user was satisfied that the water had discontinued to flow from the drain. The user would then go back to controller and complete the purge mode, which would also place the RWMS in the fully OFF position.

1st, the main water shut off solenoid will disable water supply just beyond the meter and if so equipped an electrical relay will disable water heater. (At the Well Head in rural settings) 2nd, the drain solenoid would be opened followed by or accompanied by
3rd, the vacuum release solenoid would be opened. The final process is that the RWMS Controller returns the drain and vacuum release solenoid valves to prior positions respective to each. Also since the memory of last Mode is stored in Non-Volatile Memory or memory which is not lost when power is off for any length of time, the Mode of operation will remain Purge, even if Commercial Power is lost and regained several times during the absence of the property owner/user.

6. Locate Mode: (This function is proper installation dependant)
Once a leak is detected, then it can be extremely helpful for the system to also help to determine location to the degree of answering the question(s): "Is the leak between the point in which the user is responsible for water (POR) and point of entry (POE) to the dwelling or business Also Known As (AKA) the supply line, or is it beyond the Point of Entry (POE) in the structural plumbing, or do both of these main plumbing system sections have leaks?" The information that follows couples this functionality with very important Installation Instruction which if not followed by RWMS installer would negate its usefulness. Instructions with the system, and provided via other media, will instruct the user to install a solenoid valve optionally elected for support of the Locate Mode, and not part of a Basic Residential Water Management System which MUST BE at or nearest possible to the Point of Entry. Also a second pressure sensor is installed which is optional to the Locate Mode and is installed at any convenient point in the plumbing system which is beyond the Point of Entry (POE), and is specifically used to determine the answer to the question mentioned in the first paragraph of this mode description. Since each side of the two identified sections of plumbing

mentioned in this modes description have separate pressure sensors, then the system can determine with a single test cycle as to whether one side or even both sides demonstrate intelligible reductions in pressure that would represent that a plumbing system is NOT sealed and which constitute leak associated flow. The unit will watch Pressure on the Supply Side and on the Property Side simultaneously during this Mode, which is in fact a testing mode. In this way even smaller Leaks will be found by the RWMS system and repair will be aided by directing searches for the source to that or those sides of the plumbing where the RWMS determined that a leak existed. This can save time and money for the property owner whether the leak is found and repaired by them or through private business with a Licensed Plumbing Service in their business area

7. Water Counter or "Count" Mode: (By this name or having any operational mode name in which): Encouragement of "grass root" public participation in Conservation efforts of Water Utilities, Counsels, Board and Conservation Agencies, whom propagate instructions to users for such participation which read "To determine water usage over a given period of time, locate your water meter box, then read the current meter reading, then perform a conversion calculation to convert this reading from Cubic Feet of Water to Gallons of Water, then subtract any previous amount in gallons from the current reading in gallons, but do not include the last two numbers since they are 100ths of Cubic Feet of Water Usage, and not whole numbers of Cubic Feet of Water Usage". These convoluted and confusing instructions also require many trips to the water meter to perform and do not elicit numbers of willing participants from the target group for this product to actively participate in what could be very successful Water Conservation Programs in each and every Water District, Board or Utility across the United States and abroad. However, the RWMS is uniquely designed to meet this need by providing easily acquired "counting" of water usage which will encourage and elicit Water Conservation Planning at the grass roots level, since the RWMS will allow the user to simply gain this needed data by following the very easy steps/instructions provided with the RWMS Device Packaging and on other media such as Websites:

1. Before you use the water, press the menu button on the RWMS Controller
2. Now press the number of the Water Counter Mode seen in the menu on the keypad of the RWMS Controller Device. The device begins a count from zero (0) in gallons, and displays onscreen that a count is underway, with instruction onscreen for user to complete water usage activity and return to the RWMS Controller and Press Enter/Re-Set button to get the results.
3. User returns to RWMS controller and presses the Enter/Reset option on the Electronic Controller Unit.
4. User receives instant count of water usage during activity which is displayed onscreen and or electronically voice simulated, and as an example would display or say "The total amount used during this count was "XXX" Gallons.
5. Controller device prompts user to either return to water counting mode, or to return the main menu.

This feature will readily encourage Home and Small Businesses to develop Water Conserving Habits that reduce their usage, thus providing additional Trillions of Gallons of water savings per Water District, and qualifying the RWMS as a one of a kind innovative technology which supports Water Conservation by encouraging grass root level participation by Residents and Businesses, their family members and or staff. It is therefore reasonably expected that public Water Conservation Participation would increase in numbers which would dwarf current participation with the RWMS as the Innovative Tool which allows for "Painless" acquisition of the timely data points which are the most paramount element for effective Home and or Small Business Water Conservation Planning and Programs. Plainly said, The RWMS will make water conservation an easy and fun project for families and businesses. Packaging of the RWMS product should include educational video about Home and Small Business Water Usage and Conservation needs, plus include a tracking chart so that families can make Water Conservation a fun habit, with a chart to track the progress at either the home or small business. The RWMS Electronic Controller is in constant communication with the Flow Counter/Sensor for the purpose of storing total water usage information. This same Flow

Counter/Sensor is also used during Water Counter Mode to capture individual usage for Conservation Participation purposes, while at the same time any amount of water used will still be recorded in total usage for statistical recall and display.

8. Echo Alert Mode (By this name or having any operational mode name in which): The device will receive signals from either a water softening apparatus or a filtering apparatus, which will send signal to the RWMS Controller when needed maintenace actions are required such as replacement of filters or addition of softening agents. The RWMS unit will respond to this signal by producing both visual and audible notifications of these conditions.

Installation Requirements: (Also visually determinable by examination of RWMS Drawing #1)

Shut Off Solenoid and Pressure Sensor should be installed at or nearest possibly to the property Point Of Responsibility (POR), which in most cases is the Utility Provided Water Meter, or where well water is used this point is represented by the Well Head. If possible, a mineral filtering device is recommended for prevention of deposit build up which can lessen the life expectancy of the pressure and flow sensing devices, however is not a requirement nor a part of the subject of this Patent Application. Wiring to connect the Solenoid Valve(s), and the Pressure Sensor(s) to the Controller should be buried underground. Since the function of the Flow Detection Device is dedicated to flows which would only occur in the structure piping branches, it is recommended that it be installed beyond the Point of Entry (POE), but before any branching of the plumbing system to assure that any flow of water to any water using fixture or appliance be through the flow counter and not beyond it. The installation of the Flow Counter/Sensor is ideally recommended to be inside the structure, which will add to its expected usable and functionally accurate life. Ideally the Pressure Sensor will be incorporated into the design of the Shut Off Solenoid, but will function properly if installed as separate item beyond the Main Electrically Actuated Solenoid Valve. If the Locate Mode is chosen to be active by the RWMS user, then the additional Locate Mode Pressure sensor may be installed at any point in the plumbing that is beyond the Point of Entry (POE).

Drain Solenoid should be placed at the lowest point (determinable & accessible by installer) in the water system past the point of entry into the structure. A pipe/conduit extending from that point, outside the structure, should be plumbed to elbow above ground level, and below the level of the plumbing itself. Water from the plumbing will drain outside from this solenoid when the Purge Mode (Optional) is activated. It is noteworthy that this could be even more water conservation oriented if drained water were directed to landscaping areas, which would benefit from the water. In situations where the User's Property includes subterranean (below ground) areas such as basements, an optional kit with an Electric Pump will be available, and connections for such a device will exist in all units produced. The pump would assure complete evacuation of water from a water system and could be elected by those not having subterranean areas as well.

Vacuum Release Solenoid will be installed inline with the plumbing at the Highest Point where any piping exists above ground level, and will allow air into the system to maximize the amount of water drained by preventing vacuum in the plumbing during the purge/drain. A Pump would be necessary to assure 100% evacuation, but the gravity/siphon method should be more than adequate to prevent freezing and bursting of water system piping where no subterranean piping exists.

At a convenient point (as best determined by the installer) the Locate Solenoid (If Locate Mode is chosen by user to be available and active) should be installed. It is noteworthy to mention that many structures have a manually operated valve at the Point of Entry, and the use of this valve will substitute for the Locate Solenoid, but will require that the user manually close this valve to run the Locate Mode test. The Locate Mode Pressure Sensor is however a must installation for the Locate Mode to correctly function and may be installed at any point beyond the Point of Entry (POE).

While the above describes in detail the RWMS or Residential Water Management System, it is not limited to any exact form, and changes in its detail and or construction methods would not reflect a departure from the spirit thereof.

NOTE: The main solenoid valve employed by the RWMS differs from most. Most are simply either "Normally On" or "Normally Off", and require constant electrical energy to maintain the opposite of their normal condition or state. The solenoid valve used by the RWMS has been specifically adapted with a locking mechanism which forces the valve to stay in the last state, even when commercial and or battery power is lost. This unique feature allows for the system to remain in last state until a separate unlatching signal is sent which allows the solenoid to spring back into its normal state. This valve specificially is a locking bi positional normally on valve. This valve also reports to the Controller through special lines in wiring so that the Controller can discontinue electrical energy to the solenoid once the "locked" signal is received. This application **does not make CLAIM** for any rights to said solenoid valve, but rather describes it as a part of the RWMS System. Also the valves have a manual lever which allows the home owner to manually select the on or off position should the need arrise.